



# Bayesian Games: First Definition

Game Theory Course: Jackson, Leyton-Brown & Shoham

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### Introduction

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  - the number of players
  - the actions available to each player
  - the payoff associated with each action vector
- Why is this true in imperfect information games?



### Introduction

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Now we'll relax this. We'll still assume:

- 1. All possible games have the same number of agents and the same strategy space for each agent; differing only in payoffs.
- 2. Agents' beliefs are posteriors, obtained by conditioning a common prior on individual private signals.



## **Definition I: Information Sets**

• Bayesian game: a set of games that differ only in their payoffs, a common prior defined over them, and a partition structure over the games for each agent.

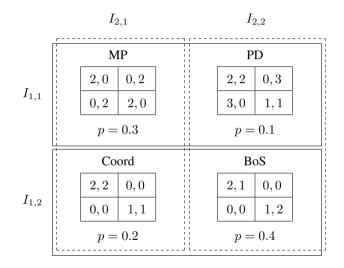


#### Definition (Bayesian Game: Information Sets)

#### A Bayesian game is a tuple (N, G, P, I) where

- N is a set of agents,
- G is a set of games with N agents each such that if  $g, g' \in G$ then for each agent  $i \in N$  the strategy space in g is identical to the strategy space in g',
- $P\in \Pi(G)$  is a common prior over games, where  $\Pi(G)$  is the set of all probability distributions over G, and
- $I = (I_1, ..., I_N)$  is a set of partitions of G, one for each agent.

#### Definition I: Example





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